the side of each. *Anus* placed in a depression at the posterior extremity of the body. *Foot* yellowish white, linear, and squared in front.

Length upwards of a quarter of an inch.

A few individuals of this species were obtained, last October, in brackish-water pools at the mouth of Hylton Dene, near Sunderland, associated with *Alderia modesta*, on a Conferva (*Vaucheria submarina*?).

The same animal, apparently, was taken by Mr. Muggridge and Mr. C. Spence Bate, in Loughor Marsh, South Wales, in 1849, similarly associated, and was figured by the latter gentleman in the Report of the Swansea Literary and Scientific Society for 1850, where it is named *Limapontia nigra*. It is, however, readily distinguished from that species by its greater size, more depressed form, and wider lateral expansion, by the backward position of the anus, and the more branched hepatic organ, besides other minor characters. Mr. Spence Bate's specimens seem to have been nearly twice the length of ours.

This species comes very near to the *Fasciola capitata* of Müller, perhaps more so than the *Limapontia nigra*, which has been referred to that species by Professor Lovén; but as Müller had not observed the characters by which these two species are more especially distinguished from each other (namely, the position of the anus and the branching of the liver), we think it better to consider our animal as new than to revive an old name that may prove to be erroneous.

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## XXVI.—*A Synopsis of the Species of Crocodiles.*

By Dr. J. E. Gray, F.R.S. &c.

The distinction of the species of Crocodiles has hitherto been one of the difficult problems in systematic zoology; and therefore I believe that it may be of some slight use to lay before the readers of the 'Annals' the result of my examination of the very large collection of Crocodiles, of all ages and from various localities, which are contained in the British Museum. Knowing the difficulty that surrounds the subject, I have made great exertions to obtain specimens from different countries; and the examination of these specimens has shown that the characters of the species, when allowance is made for the changes that take place in the growth of the animal, are quite as permanent as in any other group of Reptiles.

One of the difficulties in distinguishing the species of Crocodiles arises from the changes that take place in the form of the head during growth. When the Crocodile is just hatched, the

face is very short; it elongates as the animal grows, at first very gradually, and, at length, assumes the typical form of the species when the animal has reached about one-fourth or one-third of its natural size. The head continues to increase in firmness and strength; and when the animal has attained nearly its adult size, the bones of the head become thickened, the face becomes broader and higher, and the general form of the head is considerably altered. Thus the half-grown specimens give the most characteristic form of the species.

I have noticed that there is considerable variation in the width of the face in specimens from different localities, but which appear in other respects to belong to the same species. Some naturalists might be inclined to regard them as distinct species; but in our series, large as it is, we have not sufficient materials to decide the question with any confidence. Perhaps, if the skulls of specimens from each locality could be compared, other characters might be found; but this must be left for my successors in this field of research.

I may remark that the observation of MM. Duméril and Bibron (Erp. Gén. 25 & 47), that Crocodiles are not found in Australia, and that the American Crocodiles are confined to the islands of that continent, is no longer consistent with fact; indeed, long before the publication of their work, various travellers had recorded the occurrence of Crocodiles on the north coast of Australia; and we have received specimens of the skull of *Oopholis porosus* from thence.

The genera here proposed have the following geographical distribution :—

Asia and Northern Australia: *Oopholis* and *Bombifrons*.
Africa: *Crocodilus, Halcrosia,* and *Mecistops*.
Tropical America: *Palinia, Molinia*.

The skulls of Crocodiles may be arranged thus :—

1. Nasal bone produced, and separating the nostril into two parts. *Halcrosia*.

2. Nasal bone produced, and dividing the edges of the nostril. *Oopholis, Crocodilus, Molinia* (*americana*), *Bombifrons, Palinia*.

3. Nasal bone not reaching the nostril. *Molinia* (*intermedia*), *Mecistops*.

The large front teeth of the *Gavials* fit into a notch in the front of the upper jaw, and the canines into a notch also. In the *Crocodiles* the canines fit into a notch, as in the Gavials, but the large front teeth fit into a pit or perforation in the front of the upper jaw; and in the *Alligators* both the canines and large front teeth fit into pits or perforations in the edge of the upper jaw.

The intermaxillary bone in *Bombifrons* and *Palinia* is short and truncated behind. In *Halcrosia* it is rather produced behind, the straight sides converging to a point. In all the other genera it is produced behind, with the hinder edge converging on the sides and truncated at the ends.

The palatal bone in all the genera is truncated or rounded in front, except in *Mecistops*, where it is narrow, short, and acute in front.

The dorsal scales present considerable variations in different specimens from the same locality; but, allowing for such variations, the genera may be arranged thus:—

1. The dorsal scales nearly uniformly keeled, in four or six longitudinal series; the outer series ovate-elongate. *Oopholis.*

2. The dorsal scales nearly uniformly keeled, quadrilateral, as broad as long. *Crocodilus, Palinia, Molinia,* and *Mecistops.*

3. The dorsal scales quadrilateral, as broad as long; the vertebral series scarcely keeled, the lateral series irregular and keeled. *Halcrosia* and *Molinia.*

The eyelid of the genus *Halcrosia* is thickened, with three hard bony plates, as in some of the Alligators, with which it also agrees in the external form of the head and the disposition of the nuchal shield. In all the other genera they are thin and membranaceous.

The Crocodiles (*Crocodilidæ*) may be thus divided:—

I. *The nape with a rhombic disk formed of six plates, which is well separated from the dorsal shields.* Normal Crocodiles.

A. Nuchal scutella none. Dorsal scales in four or six longitudinal series; the outer series ovate-elongate. Toes webbed. Legs fringed. The intermaxillary bone produced, truncated, and converging on the sides. Estuarine or brackish-water Crocodiles.

### 1. Oopholis.

Face oblong; orbits with an elongated, longitudinal, more or less sinuous ridge in front. Nuchal shields none, or rudimentary. Cervical disk rhombic, of six shields. Dorsal shields uniformly keeled, in four or six longitudinal series; the vertebral series with straight internal edges, the outer ovate-elongate. Legs acutely fringed. Toes broadly webbed. Intermaxillary bone produced and truncated behind the suture, sloping backwards and converging, and then transverse or sinuous.

a. *The dorsal scales in six longitudinal series; the vertebral ones elongated like the others.*

#### 1. *Oopholis porosus.*

*Crocodilus porosus,* Schn. Amph. 159; Gray, Cat. Brit. Mus. 58.
*C. oopholis,* Schn. Amph.

*Crocodilus biporcatus*, Cuvier, Oss. Foss. v. 65, t. 1. f. 4, 18, 19 (young skulls), t. 2. f. 8; Müller and Schlegel, Verh. t. 3. f. 6 (middle-aged skull).
*Champse fissipes*, Wagler, Amph. t. 17.
*Crocodilus biporcatus raninus*, Müller and Schlegel, Verh. t. 3. f. 7 (aged skull).

*Hab.* Asia and Australia. India, Bengal and Pinang (*Hardwicke*); China (*Lindsay*); Trincomalee; Borneo (*Belcher*); North Australia (*Ince, Elsey*); Tenasserim coast (*Packman*).

The Museum specimens vary in length from 18 to 52 inches; but the skull shows that it grows to a very large size. We have one skull 29 inches long; another, which is 26 inches long, is said, by the gentleman who sent it from India, to have been taken from an animal 33 feet long.

Cuvier figures the skulls of young and half-grown specimens. S. Müller and Schlegel figure two skulls, one under the name of *C. biporcatus* (f. 6), and the other *C. biporcatus raninus* (f. 7): the latter seems to be from an adult or aged animal; the former (f. 6) from a full-grown one, before the skull is thickened and spread out. Another specimen figured as *C. biporcatus raninus* (f. 8) appears to be from a specimen of *Crocodilus Siamensis*. It certainly is not an *Oopholis*, from the form of the dorsal scales and the presence of the nuchal ones.

b. *The dorsal scales in four series; the vertebral series broader than long, the outer series elongate-ovate.*

2. *Oopholis Pondicherianus.*

*Hab.* Pondichery, 1851.

The specimen of this species in the British Museum is small, and only just hatched, but it is quite distinct from all the others. The vertebral series of shields are nearly twice as broad as the vertebral shields in *O. porosus*; the others are also rather wider in comparison; all the dorsal scales are more keeled, and the keels on the scales on the side of the base of the tail are higher and more prominent. The black spots are larger and further apart.

The specimen was purchased of M. Parzudaki of Paris, it having formed part of a collection which he received from the French Museum.

B. Nuchal plates four, or rarely two or five, in a cross series. The dorsal plates as broad as long, in four or six series. Fluviatile or River Crocodiles.

*a.* The intermaxillary bones truncated behind, with a nearly straight premaxillary suture. Face broad, oblong.

To discover the form of the premaxillary suture in the preserved specimens, it is only necessary to elevate the skin of the front of the palate, and lay the bones bare.

* *Toes webbed. Legs distinctly fringed.* Asiatic Crocodiles.

2. Bombifrons.

The premaxillary suture straight, or rather convex forwards. The face oblong; forehead with nodules in front of the orbits. The cervical disk formed of six shields. Nuchal plates four, in a curved line. Dorsal shields oblong, rather elongate, all keeled, in six longitudinal series, and with two short lateral series of keeled scales. The legs fringed with a series of triangular elongated scales. Toes webbed.

1. *Bombifrons trigonops.*

*Crocodilus bombifrons*, Gray, Cat. B.M. 59, 1844 (adult).
*C. biporcatus*, Cautley, Asiat. Research. xix. t. 3. f. 1 & 3 (not Cuvier).
*C. trigonops*, Gray, Cat. B.M. 62, 1844 (young).
*C. palustris*, Gray, Cat. B.M. (young).
*C. palustris* (part.), Dum. & Bib. Erp. Gén. ii.
*C. biporcatus raninus*, Müller & Schlegel, Verhand. t. 3. f. 7?
*C. marginatus*, Falconer, Ann. & Mag. Nat. Hist. 1846, xviii. 361, t. 7 (skull).

The intermaxillary short, nearly semicircular.

*Hab.* India, Ganges (*Dr. Sayer*); Madras (*Jerdon*); Ceylon (*Kelaart*).

The smallest specimen in the British Museum is 19 inches, and the largest nearly 10 feet long; but we have skulls showing that it grows to a much larger size.

There may be two species included in the above, as in one of the heads (that from Ceylon) the intermaxillaries appear to be longer and narrower than in the others. I have not sufficient materials to satisfy myself as to the distinction of this species and the permanence of the forms.

This species has been generally confounded with *Oopholis biporcatus* and *C. palustris*.

The face of the younger specimen is rugulose and depressed, with a deep pit on the sides over the eighth and ninth teeth; there are two arched ridges on each side behind the nostril, and some rugosities in front of the orbits. In the older skull the face is very convex and rounded, rugose, with some more or less distinct rugosities in front of the orbits, but not the distinct longitudinal ridge so characteristic of *Oopholis porosus*.

2. *Bombifrons Siamensis.*

*Crocodilus Siamensis*, Schn. Amph. 157; Gray, Syn. 60, & Cat. B.M. 63 (monstrosity).
*C. galeatus*, Cuvier, Oss. Foss. v. 52, t. 1. f. 1; Dum. & Bib. Erp. Gén. ii. 113 (monstrosity).
*C. palustris*, Lesson, Bélanger, Voy. 305?

*Crocodilus vulgaris* (part.), Gray, Syn. 58; Dum. & Bib. Erp. Gén. ii. 108; Müller & Schlegel, Verh. t. 3. f. 9 (head?).

The face depressed, elongate, nearly smooth, with a slight nodule in front of the orbits. Intermaxillaries rather elongate, half-oblong.

*Hab.* Siam, Cambogia (*M. Mouhot*).

We have a well-preserved half-grown specimen of this species in the British Museum. It differs from all the specimens of *Bombifrons trigonops* in the Collection in the face being much longer, and not so tubercular and pitted.

As the head agrees with the figure of the head from which Schneider named his species, I have retained it; and I have little doubt that the two keels which are present in that specimen are either an individual peculiarity, or perhaps a character that developed itself as the animal approached old age.

** *The legs with an indented fringe of short narrow scales. Toes short, nearly free.* American Crocodiles.

### 3. Palinia.

The premaxillary suture straight (see Cuvier, Oss. Foss. iii. 72, t. 3. f. 1, 5). The face oblong; forehead very convex, with a ridge in front of each orbit, converging in front and forming a lozenge-shaped space. Nuchal plates two or four, unequal. Cervical disk rhombic, of six large shields. Dorsal shields large, broad, in six series; the vertebral series nearly smooth, the lateral one strongly keeled.

#### 1. *Palinia rhombifer.*

*Crocodilus rhombifer*, Cuv. Oss. Foss. v. t. 3. f. 1–5 (skull); Sagra, Cuba, t. 4; Dum. & Bib. Erp. Gén. iii. 97.
*C.* (*Palinia*) *rhombifer*, Gray, Cat. B.M.

The upper surface of the fore-arms and thighs covered with convex keeled scales; the outer edge of the legs and feet with a series of very elongated scales, forming only a slight fringe; the toes short, scarcely webbed.

In the British Museum there is a nearly adult stuffed specimen, received from M. Ramon de la Sagra, and two young specimens sent from Cuba by Mr. W. S. Macleay. The young specimens (in spirit) are pale brown, with small dots on the head, and a dark spot on the middle of many of the dorsal scales. Tail subtessellated, with square brown spots.

*C. planirostris*, Graves (*C. Gravesii*, Bory), is only described from an old specimen, in a very bad state, in the Museum of Bordeaux. The description and figure agree with those of *P. rhombifer* in almost every respect, except that the hind toes are

said to be webbed. It was supposed to come from Congo; but that is very doubtful.

2. *Palinia? Moreletii.*

*Crocodilus Moreletii*, Dum. Arch. du Mus. vi. 255, t. 20; Cat. Rept. 28. n. 5*.

Dorsal scales keeled, nearly square; scales of the sides and limbs smooth, without tubercles.

*Hab.* Yucatan, Lac Flores (*M. Morelet*).

This species is from a specimen in the Museum of Paris, which is very badly figured and indistinctly described in the memoir above cited.

There are two young specimens of Crocodiles, in spirit, without habitats, in the British Museum, which are peculiar in the large size of the nuchal shield, the strength of the keels of the dorsal shields, and the large keeled scales of the fore-arms and thighs, in which they agree with *Palinia rhombifer*; but there is so much difference between the two, and between them both and the specimens of that species from Cuba, that I think they must be left in doubt, for further elucidation. There are also two small stuffed specimens in the Collection (purchased in shops, and without any locality attached), which are peculiar in having six series of uniform, squarish, very strongly keeled dorsal scales: they are very unlike any other specimen in the Collection, and may be new; but I do not like to describe them in the present imperfect state of our knowledge.

b. The intermaxillary bone elongate, produced and truncated behind; the suture sloping backwards and converging, and then transverse or sinuous. Toes webbed. Legs with a fringe of elongated triangular scales.

4. Crocodilus.

Face oblong, depressed, without any ridge in front of the orbits. Nuchal shields four, in an arched series. Cervical disk rhombic, of six shields. Dorsal shields quadrilateral, as broad as long; the vertebral series rather the widest and most keeled.

*Crocodilus vulgaris.*

*Le Crocodile de Nile*, Daud. Rept. ii. 267.
*Crocodilus vulgaris*, Cuvier, Oss. Foss. v. 42, t. 1. f. 5 & 12, t. 2. f. 7.
*C. Chamses*, Bory, Dict. Class. H. N. v. 105.
*C. lacunosus*, Geoff. Croc. d'Egypte, 167.
*C. suchus*, Geoff. Ann. Mus. x. 82, t. 5. f. 2, 3, 4.
*C. marginatus*, Geoff. Croc. d'Egypte, 165; Gray, Cat. Rept. B.M. 61.

*Hab.* Africa. North Africa, Egypt; West Africa, Senegal, Gaboon; South Africa, Cape of Good Hope; Central Africa (*Baikie*).

Our largest specimen is nearly 15 feet long.

The specimens from Egypt, West Africa, and the Cape show

some slight differences; and perhaps a complete series of the perfect specimens and skulls, of different ages, from each locality might prove them to be distinct; but, unfortunately, I have not such a series at my command, all the specimens from the Cape and West Africa being either in the adult or very young state.

### 5. Molinia.

Face elongate; forehead swollen, convex, especially in the adult; orbits without any anterior ridge. Nuchal shields two or four, small. Cervical disk rhombic, of six shields. The legs fringed with a series of triangular elongate scales. Toes webbed. Scales of the fore-arm and thigh thin, smooth.

* *Face slender. Dorsal shields irregular; the central series small, keeled; lateral scattered, strongly keeled. Nasal bones produced to the nostrils.* Molinia.

#### 1. *Molinia americana.*

*Crocodilus americanus* (*Plumieri*), Schn. Amph. 167; Gray, Cat. B. M. 60.
*C. acutus*, Geoff. Ann. Mus. ii. 53, t. 57. f. 1; Cuvier, Oss. Foss. v. t. 1. f. 3 & 14, t. 2. f. 5; Gray, Syn. 60; Dum. & Bib. Erp. Gén. iii. 120.

*Hab.* Tropical America. Cuba (*W. S. Macleay*); West Ecuador (*Fraser*); Nicaragua (*Richardson*); West coast of America (*Belcher*); St. Domingo (*Cuvier*).

Our specimens vary in length from 19 to 103 inches; and the skulls show that they grow to a larger size.

*Var.* with two additional small cervical scutella behind the others.

*C. americanus*, var. *c*, Gray, Cat. Rept. B.M.
*C. acutus*, var., A. Dum. Cat. Rept. 28; Arch. du Mus. vi. 256.

*Hab.* West coast of America (*Belcher*); Mexico (*Warwick*).

** *Face very slender. Dorsal shields nearly uniform. Nasal bones not produced quite to the nostrils.* Temsacus.

#### 2. *M. intermedia.*

*Crocodilus intermedius*, Graves, Ann. Sci. Phys. ii. 248; Gray, Syn. 59.
*C. Journei*, Bory, Dict. C. H. N. v. 111; Dum. & Bib. E. G. iii. 129; Huxley, Proc. Linn. Soc. iii. 11.
*Croc. de Journie*, A. Dum. Arch. du Mus. x. t. 14. f. 3 (head).

Dorsal shields in six rows, all slightly and nearly equally elevated; the keels of the two vertebral series rather larger than the others, quadrilateral, rather broader than long; the lateral ones oval, with five or six large shields forming an interrupted line on the sides.

*Hab.* America.

We have a young specimen, in spirits, sent by Mr. Brandt of Hamburg, as *Crocodilus acutus*, and an adult skull received from Paris, as *Crocodile de l'Orénoque*.

II. *Nape with a broad ridge, strongly keeled on each side, and nearly continuous with the dorsal shield, formed of two or three pairs of keeled shields. Legs fringed. Toes webbed.* Abnormal Crocodiles.

* *Face broad; nasal bone produced into the nostril.* Alligatorian Crocodiles.

### 6. Halcrosia.

The premaxillary suture transverse, rather convex backwards. Nasal bones produced beyond the intermaxillary, and forming a bony septum between the nostrils. The face oblong, broad, without any ridge in front of the orbit. Eyelid with two bony plates. Nuchal plates four, in a cross row, strongly keeled. Cervical plates three or four pairs, forming a ridge on each side, the hinder one smaller. Dorsal scales in four series; the central broad, slightly keeled, the outer narrow, distinctly keeled: sides with large convex scales.

*Halcrosia frontata* (Black African Crocodile).

*Krokodile noir de Niger*, Adanson, MSS., Mus. Paris; see Cuvier, Oss. Foss. iii. 41.
*Crocodilus palpebrosus*, var. 2, Cuvier, Oss. Foss. iii. 41, t. 2. f. 6 (part.).
*C. trigonatus*, part., Cuvier, Oss. Foss. iii. 65.
?*C. biscutatus*, Cuvier, Oss. Foss. iii. 53, 65 (jun.).
?*C. bisulcatus*, Bory, Dict. Class. H. N. v. 108 (a misprint?).
*C. frontatus*, A. Murray, Proc. Zool. Soc. 1862.

*Hab.* West Africa. Senegal (*Adanson*); Gaboon; Old Calabar.

The *Crocodilus biscutatus* (Cuvier, Oss. Foss. v. 53, 65, t. 2. f. 6, nuchal plates), from a young specimen labelled "*Gavial de Sénégal*" by Adanson, is probably a young specimen of this species; but Adanson's name would appear to apply to *Mecistops*.

There is a specimen nearly 4 feet long in the Liverpool Museum; indeed, this seems to be the most common Crocodile of the West-African rivers.

Cuvier evidently confounded this species with the *Alligator palpebrosus* of South America; and it is still confounded with that species by the French naturalists, for we have a skeleton lately sent from the French Museum under that name.

** *Face very long, slender; nasal not reaching to the nostril.* Gavialian Crocodiles.

### 7. Mecistops.

Face subcylindrical, scarcely dilated in the middle; orbits simple. Nuchal shields numerous, small, in two cross series. Cervical disk narrow, containing two or three pairs of shields. Dorsal shields small, all keeled, in six longitudinal series, lateral one narrowest. Intermaxillary produced behind, and embracing the front end of the nasal.

This genus has some resemblance to the Gavials; but the

structure of the skull and the position of the teeth are those of a true Crocodile.

*Mecistops cataphractus.*

*Crocodilus cataphractus*, Cuvier, Oss. Foss. v. t. 5. f. 1, 2; Dum. & Bib. E. G. iii. 126 (younger) [copied A. Dum. Arch. du Mus. x. t. 14. f. 2]; Bennett, Proc. Zool. Soc. 1834, 110.
*C. leptorhynchus*, Bennett, Proc. Zool. Soc. 1835, 129; A. Dum. Arch. du Mus. v. 252 & i. 171. t. 14. f. 1.
*M. cataphractus*, Gray, Cat. B.M. 58.
*M. Bennettii*, Gray, Cat. B.M. 57.

*Hab.* West and Central Africa. Fernando Po (*Bennett*); Gaboon; Lagos; Central Africa (*Baikie*).

I think there can be no doubt that the *Crocodilus cataphractus*, figured by Cuvier from a specimen in the College of Surgeons, and the *C. leptorhynchus* of Bennett are one species, the difference in the length of the beak (in the figure) and in the form of the nuchal disk being derived from the state and age of the specimen.

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## XXVII.—*Notes on rare and little-known Fishes taken at Madeira.*

By James Yate Johnson, Cor. Mem. Z. S.

No. II.

Order ANACANTHINI, Müll.

Suborder Thoracici.

Fam. Gadidæ.

*Phycis blennoides*, Bl., Schn.

*Blennius gadoides*, Risso.

1st D. 9. 2nd D. 58. P. 17. V. 1. A. 53. C. iii. 18. iii. M.B. 7. Scales of lat. line about 100.

Body elongate-oblong, much compressed behind, of a brownish-grey colour; the belly pale grey, marbled with dirty white.

The *head* is depressed, unarmed, and, compared with the total length, is as 1 to $4\frac{1}{3}$. Gill-openings large; the gill-covers, which are black inside, are small, and leave much of the branchiostegal membrane exposed. The scaly cheeks are slightly convex, and the skin covers and conceals the preopercle. The opercle is without a notch, and it terminates behind in a rounded projection. The snout is short, rounded, and covered with small scales; there are also scales on the mandible, but none on the thick cartilaginous lip. There is no coloured skin on the maxillary, which fits under the skin behind, and forms no part of the border of the mouth. It reaches back to the vertical from the middle of the eye. The mouth, when open, is nearly circular.